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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/628,614
Filing Date: July 28, 2003
Appellant(s): YOUNG ET AL.

L. Jon Lindsay
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed April 11, 2006, the amended appeal brief filed September 10, 2007 and the amended appeal brief filed May 11, 2009 appealing from the Office action mailed December 1, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,906,794	Tsuji	6-2005
5659172	Wagner et al	08-1997
7013222	Strader	03-2006

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 4 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Tsuji 6,906,794.

Tsuji discloses a semiconductor wafer inspection system comprising: an image capturing device (60, 74, 100, a microscope with a review system) to view at least a portion of an edge of the wafer (2) and generating a plural images of the edge of the wafer; a database (75, 76, 77, 78) receiving the generated images and storing the received images for subsequent analysis and/or inspection (columns 6-10); and a computer (75, 76) to retrieve the selected stored image upon instructions from a user/operator to perform image analysis to locate and identify any defects on the edge of the wafer (columns 6-11). Tsuji also discloses the method of operation including setting desired angles of the image capturing device relative to the edge of the wafer (Figures 2, 6, 10), magnification of the device, focus of the device, brightness of an

illumination source, and the rotational speed of the wafer (columns 4-7). The Tsuji' s system inherently performs the claimed method steps.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2, 3, 5-7, 10-15 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuji 6,906,794.

With respect to claims 2 and 3, although Tsuji fails to specify whether or not the microscope of the image capturing device including the use of a scanning electron microscope, the use of a scanning electron microscope for capturing image in an optical inspection system in order to provide better image information/data would have been known in the art. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Tsuji accordingly in order to provide more accurate inspection results from the system. The further inclusion of setting an accelerating voltage of an electron beam would have also been obvious for similar reasons set forth above.

With respect to claim 5, although Tsuji lacks a clear inclusion of scanning the edge of the wafer from a region interior of a top to a region exterior of a bottom of the

edge, selecting a specific manner for scanning an object to be inspected or a wafer for providing a specific pattern of image to be taken by the image capturing device would have been obvious to one of ordinary skill in the art. It would have been obvious to modify Tsuji accordingly in order to provide a better image pattern to be recorded or stored or displayed, if so desired.

With respect to claims 6 and 7, although Tsuji lacks a clear inclusion of comparing the previous defect information to the after defect information to locate any added defects and/or any repaired defects, repeatedly inspecting the same area or portion of an inspected object or wafer for ensuring a complete inspection performance would have been obvious to one of ordinary skill in the inspection art. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Tsuji accordingly in order to provide a more reliable inspection performance of the system.

Regarding claims 10-15, although Tsuji discloses different scenarios during the operation of the system but lacks a clear inclusion of an inspection during fabrication of integrated circuit components on the wafer, and a plurality of inspection stations within the fabrication system, it would have been inherently included ("defect inspection is executed in each manufacturing step", columns 1-2; "the wafer edge portion entirely comes within the field of view of the objective lens", column 5; "the related defect data and the image data are preferably stored. The defect data and the image data may be used in subsequent inspection", column 6), however, if not, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Tsuji accordingly in order to provide a faster production line for making a semiconductor wafer. The

further selection of a recorded image or images the associated defect determination would have been obvious to one of ordinary skill in the art for similar reasons set forth above.

Regarding claims 17-20, the inclusion of a second image capturing device would have been an obvious aggregation to one of ordinary skill in the art, thus, it would have been obvious for one of ordinary skill in the art at the time of the invention to modify the proposed system of Tsuji, discussed in the discussion of claims 10-15 above, for similar reasons set forth above. The inclusion of the determination of any added defects and/or repaired defects would have been obvious for similar reasons set forth in the discussion of claims 6 and 7 above.

(10) Response to Argument

The brief, pages 10-12, argues that the Tsuji reference does not teach or suggest the limitation of "positioning the image capturing device at a desired angle relative to the edge of the wafer", this is found no persuasive because at least in column 7, Tsuji states that "the objective lens may be moved to the position located above the wafer edge portion". The image capturing device, of Tsuji reference, comprises an imaging device 100 capturing image data through an objective lens 60, hence, the act of moving or positioning of the objective lens is the operation/performance of moving or positioning of the image capturing device at a (desired) position located above the wafer edge portion which is a desired angle relative to the edge of the wafer. In addition, in column

8, Tsuji discloses "(W)hen the imaging device 74 is moved closer to the wafer 2". Thus, the Tsuji reference does disclose the feature of "positioning the image capturing device at a desired angle relative to the edge of the wafer" as claimed by the present application. The arguments of whether or not the movement or position of the imaging device 74 disclosed by Tsuji would affect the angle of imaging device 74 relative to the wafer 2 is incorrect because the claim (4) simply claims a method step of "positioning the image capturing device at a desired angle relative to the edge of the wafer" without concerning whether or not the positioning of the image capturing device would change or given any affect to the angle of imaging device relative to the wafer. With respect to arguments regarding the inherency of (method/use) operation/performances of the system disclosed by Tsuji, it is noted that Tsuji does disclose the structure of the (defect inspection) system with the inclusion of how and in what manner the elements/components of the system being operated/performed. For example, in column 4, at least on lines 56-58, Tsuji discloses "A description will now be given as to how the semiconductor wafer inspection apparatus of the above structure operates" and so on in the following columns 5-6, Tsuji does disclose the exact manner and steps (also Fig. 3) of how and in what manner the system being operated/performed, thus, although Tsuji does not clearly state method steps of inspecting as claimed, an ordinary skill in the art could certainly determine the inherency of the claimed method steps based on sufficient teaching/discussion, mentioned above, disclosed by Tsuji.

The brief, on pages 12-14, argues that because the Tsuji reference uses a joystick pointing device 50 to control the position and rotation of the components/devices and thus, the image capturing device is not be able for "automatically generating an image of the edge wafer" as claimed, this is an incorrect conclusion because the pointing device 50, at least disclosed by Tsuji, is used to control the movement of the system's stage 30 and/or to control the rotation of the rotatable table 21 of the system but NOT for controlling the operation/performance of the image capturing device (see columns 5-6 and figures 2-3). There is NO indication of whether or not the imaging device or camera 74 of Tsuji is manually operated by a user or operator. Instead, at least in columns 8-10 and the related illustration figure 6, a wafer edge inspection system, according to Tsuji reference, includes an imaging device or a movable camera, even a time delay camera 74 connected to an edge defect processing section 75 having an image memory and a main control 76 such as CPU for further processing the image signals from the imaging device and the desired operation/performance of the Tsuji system. Referring to operations/performances of the imaging device, Tsuji discloses that "the imaging device 74 captures images of the wafer edge portion of the wafer when this wafer 2 is rotated at a constant speed by the aligner" and the "images are captured at arbitrary angle" (column 10), which at least indicative that the imaging device or imaging capturing device is automatically generating images of the inspected wafer or the operation/performance of the imaging device is controlled/activated by another device such as the aligner but not by a (manually) action of a human or user. With respect to appellant statement, on page 13

that "Tsuji clearly indicates that the imaging device captures an image when the operator manually depresses a rotation stop button", this is an incorrect statement. Tsuji, clearly indicates that the start/stop of the rotation mechanism driving section is (manually) controlled by the operator. Then, in response to the rotation of the rotatable table, the imaging device captures an image of the edge portion of the wafer. With this indication, it is clearly to understand that the imaging device automatically captures the image (of a portion of the wafer) when the desired target (wafer) is ready. The image capturing action is automatically performed by the imaging device but not be taken by the operator. Thus, the Tsuji reference does disclose the feature of an imaging device for automatically generating an image as claimed.

The brief, on pages 14-16, argues that it is not obvious for modifying the disclose of Tsuji by replacing the imaging device disclosed by Tsuji with a scanning electron microscope for providing better image information/data of the inspected wafer, this is found not persuasive because, as an ordinary skill in the art, examiner has found it has been known and available in the art that due to the microscopic size of features on a wafer, the suspicious defect, if any, on the wafer could become smaller than the wavelength of a visible light or any conventional light optics, the use of a scanning electron microscope for capturing image in a wafer defect inspecting system, for producing "image quality", has been known and being used in the art (at least see U.S. Patent no. 5,659,172 to Wagner et al and/or U.S. Patent no. 7,013,222 to Strader attached hereto). In addition, the appellant' arguments including a statement of "image magnification in the SEM is not a function of the power of the objective lens", from the

attached Wikipedia, is also not found persuasive because the examiner proposed of the use of a scanning electron microscope or a replacement of a scanning electron microscope instead of an imaging device, disclosed by Tsuji but not "the use" or "replacement" of an objective lens of a scanning electron microscope. Therefore, the proposed modification of Tsuji, suggested by the examiner is proper.

The brief, on pages 16-17, argues that the Final Office Action does not discuss the limitation in formulating the rejection of claim 3, this statement is incorrect because there is a clear discussion of claimed features, claims 2 and 3, on page 3 of the Final Office Action. Appellant had not argued, in the previous Appeal brief, to the proposition, by the Examiner, set forth in the Final Office Action, therefore, the rejection/discussion of the proposition of the claims 2 and 3 have not been repeated/discussed in the Examiner's response/answer. The inclusion of method steps of setting an angle for the (image capturing device) scanning electron microscope and accelerating voltage of electron beam would have also been inherently included (See Strader 7,013,222, columns 6-7) if a scanning electron microscope has been utilized as proposed by the examiner.

The brief, on pages 17-18, argues that it is not obvious for selecting a specific manner for scanning an object or a wafer in an optical inspecting system, this is found not persuasive because, as stated by the examiner, although Tsuji lacks a clear inclusion of any selection of scanning manner, Tsuji does disclose an optical inspection system that inspecting the edge portion of a wafer, and if there is a need for recognizing an identification mark, in the inner side of the edge portion and/or in its neighboring

portions (see columns 13-14), the imaging device can be moved to the location/position where the mark is located. Thus, it is possible or obvious to one of ordinary skill in the art to modify the Tsuji' system by selecting a specific scanning manner as claimed if the desired inspection of the edge portion and its neighboring portions (of the wafer) were needed since the disclosed availability of the moveable imaging device and/or the wafer. This would also provide an image pattern of imaged defect information of different types, areas and sizes to be stored/recorded or displayed to the user of the system. The arguments regarding whether or not the selections being made due to a start/stop button being manually controlled by an operator is obviate since the proposed selection could be made automatically or manually without altering the basis operation/performance of the system (claim 5).

The brief, on pages 18-21, argues that since Tsuji reference only disclose the use of stored related defect data and the captured image data for subsequent inspection, column 6, and a comparison of the captured image data with image data of a good quality wafer, therefore, it would have not been obvious to modify the disclosure or the teaching of Tsuji, as found motivation from the examiner, by including a clearly discussion the method steps of comparing the defect information (data) recorded (stored) after each processing step to the defect information recorded from other processing steps and that any of added defects and/or repaired defects can be identified, this is not found persuasive because Tsuji system determines different kinds of defects, number of defects and/or coordinate positions of the defects on each wafer with a plurality of image data/information being compared/stored and even updating the

data/information of a "wafer of good quality" in its plural operations/performances (See columns 8-10 wherein at least in column 9, lines 6-13 Tsuji stated "The image data on the semiconductor wafer 2 of good quality, which is stored in the good-quality image data memory 78, is belt-like image data obtained with respect to a wafer 2 which is considered to be a good one in previous inspection. Alternatively, the wafers 2 of one lot are sequentially inspected, and each time a wafer 2 of good quality is determined, the image data of that wafer 2 is used as updating data"). The above statement indicates that at least imaged defect information/data of "a wafer of good quality" has been compared and updated. Note that the "wafer of good quality" and/or "good-quality image data" disclosed by Tsuji is considered as claimed "defect information" (of a wafer), thus, the obviousness for a proposed modification, suggested by the examiner, based on the already available operation/performances such as using related defect data and the image captured data for subsequent inspection and comparison of defect data or image data for each wafer for providing more accurate inspection result from the system would have been reasonable and/or favorable to one of ordinary skill in the wafer inspection art. Thus, the proposed modification set forth by the examiner is proper.

The brief, on page 22, argues that the Tsuji' system appears to disclose a manual operation/performance but not automatic operation/performance. As per the discussion and/or response above regarding the automatically operation/performances of the Tsuji' system, it is noted that in columns 8-10 and the at least related figure 6 of Tsuji reference describe a structure of a wafer edge inspection system comprising: an

imaging device capturing images of the wafer edge portion of a wafer when the wafer is rotated at a constant speed by an aligner, an image memory 77 which stores image data or image signals from the imaging device 74, a defect detecting section 79 comparing the captured image data with the good-quality image data for determining defects, a good-quality image data memory, a display section, etc. whose are controlled by a main controller or computer 76. Thus, it appears that the imaging device is automatically inspecting or capturing image as soon as the wafer is rotated at a constant speed by an aligner, and the memory is (automatically) stored image data in accordance with a command from the main controller but not by a human or user interface. Thus, the Tsuji reference discloses the claimed features. Note that the arguments regarding the method steps of "automatically recording a first and second sets of defects" and "determining a different between the first and second sets of defects" in claims 10 and 11 is moot because Tsuji does disclose a manner of comparing the image data between different inspecting operations/performances and even updating the stored good-quality-image data in the memory.

The brief, on pages 23, argues that since the Tsuji reference does not clearly disclose or suggest the operation of "correlating each recorded image with the wafer from it was taken and the process step after which it was taken", therefore, the claimed invention would not be obvious to one of ordinary skill in the art for a proposed modification suggested by the examiner, this is not found persuasive because the Tsuji reference discloses the related defect image data and the image data are preferably stored for further comparing with image data from subsequent inspection (column 6),

and also, image data regarding positional information of the defects may be displayed on a wafer map, and the kinds of defects may be indicated in different colors so that it is possible to visually recognize what kind of defect the wafer has, locations, areas or sizes of the defects (columns 9-10). In addition, at least in figure 5 and the corresponding discussion columns 6-7, of Tsuji reference, disclose an operation screen which can display which portion of the wafer is being observed at the present time while a portion of the wafer with defects detected by the image processing is also displayed on the wafer map. These performances of the operation screen are considered similar to the correlating operations/performances claimed by the present application. Thus, the obviousness and proposed modification suggested by the examiner is proper a favorable to one of ordinary skill in the wafer inspection art. Accordingly, the rejection set forth above is proper.

The brief, on pages 23-24, argues that Tsuji reference cannot be obvious to modify, as suggested by the examiner, for being lack a clear teaching of selecting recorded images by specifying the process steps after which each selected image was taken and determining whether any defects were added to the edge of the wafer. Similar to the response above, although Tsuji lacks a clear inclusion of “selecting” and/or “specifying” operation for the defect data as claimed, Tsuji does disclose the operation/performances of: comparing the defect image data, updating defect image data after sequential inspection performances, classifying and displaying defect data according to their kinds, positions and/or sizes, wherein those operations/performances would have obviously been inherent selecting and specifying performances as claimed.

Note that kinds of defect data, sizes and their corresponding position on a particular inspected wafer are classified and displayed accordingly as being shown in figure 7 and discussed in columns 9-10. Tsuji, however, lacks a clear inclusion of whether or not the selecting and specifying performances being done for a particular recorded image and/or wafer and so that any further defect data being recognized. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Tsuji accordingly in order to provide a more accurate inspection result from the system because Tsuji does includes options or updating image data from the old image data and using the new-updated image data from the memory for comparing with a new image data in order to provide any possible appearance of newly found defects and/or new quality of a good quality wafer.

The brief, on pages 24-25, argues that Tsuji reference only comparing an image data of a wafer with an image data recorded of a previously-inspected wafer of good quality but not comparing the first and second image data for determining whether any defects being added to the wafer and thus, it would have not obvious to modify the Tsuji reference as proposed by the examiner, this is found not persuasive because Tsuji does disclose at least an updating the image data of the good quality wafer which was stored in the image memory and comparing the image data between a new image data with the new-updated image data of the good quality wafer for analyzing types of the defects, number of the defects and/or the areas (sizes) of the defects. Although Tsuji lacks a clear teaching of updating any new defect being added to the wafer but Tsuji does includes options or updating image data from the old image data and using the

new-updated image data from the memory for comparing with a new image data in order to provide any possible new (types, areas or sizes of the) defects. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Tsuji by comparing the first image data with a second image data of a wafer for providing more quality to the inspection result from the system. Note that the defect processing disclosed by Tsuji includes a main controller having a computer for retrieving image data stored in the memory.

The arguments regarding dependent claims, on page 25 of the brief, are also included in the response set forth above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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/Que T. Le/

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